

METHANOL

Methanol is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 67-56-1

CH₃OH

Molecular Formula: CH₄O

Methanol is a flammable, colorless, volatile liquid. It is miscible in water, ethanol, ether, benzene, and ketones. Although it has an alcoholic odor when pure, crude material may have a repulsive pungent odor (Merck, 1989). Methanol burns with a non-luminous bluish flame. It is a highly polar substance (Sax, 1987).

Physical Properties of Methanol

Synonyms: carbinol; methyl alcohol; methyl hydroxide; wood alcohol; wood spirit; methylol; colonial spirit

Molecular Weight:	32.04
Boiling Point:	64.7 °C
Melting Point:	-97.8 °C
Flash Point:	12 °C (54 °F) closed cup
Autoignition Temperature:	878 °F
Vapor Pressure:	92 mm Hg at 20 °C
Density/Specific Gravity:	0.7915 at 20/4 °C (water = 1)
Vapor Density:	1.11 (air = 1)
Log/Octanol Water Partition Coefficient:	-0.77
Conversion Factor:	1 ppm = 1.31 mg/m ³ at 25 °C

(Howard, 1990; Sax, 1989; HSDB, 1991)

SOURCES AND EMISSIONS

A. Sources

Methanol is used as a solvent; in various adhesives, cleaners, and inks, and end-product manufacturing, storage and handling (U.S. EPA, 1993c). Other sources include combustion of biomass, refuse, and plastics, manufacture of petroleum, charcoal, plastics and starch, rendering, exhaust from gasoline and diesel engines, tobacco smoke and wood pulping (Howard, 1990).

The primary stationary sources that have reported emissions of methanol in California are pulp mills, manufacturers of industrial organic chemicals, and manufacturers of electronic components and accessories. Other sources include crude petroleum and natural gas extraction, manufacturers of household furniture, and manufacturers of plastics products (ARB, 1997b). Methanol has also been detected in motor vehicle exhaust by the ARB (ARB, 1995e).

Methanol (methyl alcohol) is registered as an adjuvant for agricultural use. It is used to facilitate the application of other agricultural products. The licensing and regulation of pesticides for sale and use in California are the responsibility of the Department of Pesticide Regulation (DPR). Information presented in this fact sheet regarding the permitted pesticidal uses of methanol has been collected from pesticide labels registered for use in California and from DPR's pesticide databases. This information reflects pesticide use and permitted uses in California as of October 15, 1996. For further information regarding the pesticidal uses of this compound, please contact the Pesticide Registration Branch of DPR (DPR, 1996).

B. Emissions

The total emissions of methanol from stationary sources in California are estimated to be at least 3.9 million pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Methanol has been identified as a volatile emission product from evergreen cypress trees and is also formed during the biological decomposition of biological wastes, sewage, and sludges. Other natural sources include volcanic gases, vegetation, microbes, and insects (Howard, 1990).

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of methanol. However, the United States Environmental Protection Agency (U.S. EPA) has compiled ambient air data from several locations in the United States from 1990-91. From these data, the U.S. EPA has calculated a mean ambient concentration of 23.1 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) or 17.6 parts per billion (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

No information about the indoor sources and concentrations of methanol was found in the readily-available literature.

ATMOSPHERIC PERSISTENCE

Based on its vapor pressure, methanol is expected to exist almost entirely in the vapor phase in the ambient atmosphere. The dominant chemical loss process for methanol is by reaction with the hydroxyl (OH) radical. The calculated half-life and lifetime of methanol due to reaction with the OH radical are 11 days and 15 days, respectively. The product of this reaction is formaldehyde (Atkinson, 1995). Washout due to rain is expected to be significant due to methanol's water solubility. The detection of methanol in thunderstorm water tends to confirm this supposition (Howard, 1990).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics "Hot Spots" Program (AB 2588). Of the risk assessments reviewed as of December 1996, for non-cancer health effects, methanol contributed to the total hazard index in 26 of the approximately 89 risk assessments reporting a total chronic hazard index greater than 1. Methanol also contributed to the total hazard index in 4 of the approximately 107 risk assessments reporting a total acute hazard index greater than 1 (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to methanol are inhalation, ingestion, and dermal contact (Howard, 1990).

Non-Cancer: Methanol is a central nervous system depressant and neurotoxicant. Acute exposure to methanol may result in headache, vomiting, irritation of the nose and throat, dilation of the pupils, feeling of intoxication, loss of muscle coordination, excessive sweating, bronchitis, convulsions, and death. Very high exposures may result in stupor, cramps and visual difficulties such as spotted vision, sensitivity to light, eye tenderness, and blindness. Recovery is not always complete and symptoms may recur without additional exposure. Nerve damage may occur causing loss of coordination and blindness. Because methanol is slowly eliminated from the body, repeated exposure to low levels may cause severe symptoms due to accumulation.

A chronic non-cancer Reference Exposure Level (REL) of $620 \mu\text{g}/\text{m}^3$ is listed for methanol in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoint considered for chronic toxicity is the central or peripheral nervous system (CAPCOA, 1993). The Reference Concentration (RfC) for methanol is under review by the U.S. EPA. The oral Reference Dose (RfD) for methanol is 0.5 milligrams per kilogram per day based on indications of adverse liver effects and decreased brain weight in rats. The U.S. EPA estimates that consumption of this dose or less, over a lifetime, would not likely result in the occurrence of chronic non-cancer effects.

No information is available on adverse reproductive or developmental effects in humans from exposure to methanol. Developmental studies in rats exposed to methanol by inhalation have shown birth defects involving skeletal, cardiac, and urinary system deformities

(U.S. EPA, 1994a).

Cancer: No information is available on the carcinogenic effects of methanol in humans or animals. The International Agency for Research on Cancer and the U.S. EPA have not classified methanol for carcinogenicity (IARC, 1987a; U.S. EPA, 1994a).